CLAIMS
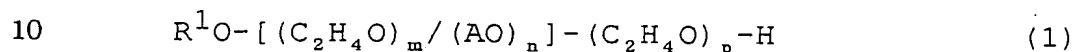
1. A nonionic surfactant comprising an aliphatic alcohol alkylene oxide adduct (A),

said (A) being directly produced by adding an alkylene oxide (b1) to an aliphatic alcohol (a1) and satisfying the following (i), (ii) and (iii):

(i) comprising one compound represented by the following formula (1) or a mixture of two or more thereof:

$$R^1O-[(C_2H_4O)_m/(AO)_n]-(C_2H_4O)_p-H \qquad (1)$$

wherein R^1 is an aliphatic hydrocarbon group containing 8-24 carbon atoms or a cycloaliphatic hydrocarbon group containing 8-24 carbon atoms; A is an alkylene group containing at least 3 carbon atoms; m is 0 or an integer of 1 or more, the average thereof being in the range of 0-4, n is 0 or an integer of 1 or more, the average thereof being in the range of 0-3, p is 0 or an integer of 1 or more, the average thereof being in the range of 1-80, (m+n+p) is an integer, the average thereof being in the range of 3-81, and the average of (m+p)/(m+n+p) is at least 0.5; and, in case of $m \neq 0$ and $n \neq 0$, $\{(C_2H_4O)m/(AO)n\}$ represents block addition or random addition;

(ii) having a ratio Mw/Mn of a weight-average molecular weight (Mw) to a number-average molecular weight (Mn) satisfying the following relation (2) or (3):

$$Mw/Mn \leqq 0.030 \times Ln(v)+1.010 \quad \text{(in case of } v<10) \qquad (2)$$

$$Mw/Mn \leqq -0.026 \times Ln(v)+1.139 \quad \text{(in case of } v \geqq 10) \qquad (3)$$

wherein v represents the average of (m+n+p) in the above general formula (1); and

(iii) having a distribution constant (c), determined by the following equation (4), of 1.0 or less, this being required only in case of v up to 12:

$$c = (v + n_0/n_{00} - 1) / [Ln(n_{00}/n_0) + + n_0/n_{00} - 1] \qquad (4)$$

wherein v is the same in the above, n_{00} represents the molar number of the aliphatic alcohol (a1) used in the reaction, and

n_0 represents the molar number of the aliphatic alcohol (a1) unreacted.

2. The nonionic surfactant according to Claim 1, wherein the n in the general formula (1) is 0 or an integer of 1 or more, the average thereof being in the range of 1-3.

3. The nonionic surfactant according to Claim 1, wherein the n in the general formula (1) is 0, and the (A) has a ratio Mw/Mn of a weight-average molecular weight (Mw) to a number-average molecular weight (Mn) satisfying the following relation (6) or (7) instead of the relation (2) or (3):

$$Mw/Mn \leqq 0.020 \times Ln(v) + 1.010 \quad \text{(in case of } v < 10) \quad (6)$$
$$Mw/Mn \leqq -0.026 \times Ln(v) + 1.116 \quad \text{(in case of } v \geqq 10) \quad (7)$$

wherein v represents the average of (m+p) in the above general formula (1).

4. The nonionic surfactant according to Claim 1, which satisfies any of the following (v) - (viii):
(v) comprising (A) having an HLB of 5-13, and having an emulsifiability index s for a mineral oil, having an aniline point of 70°C and a viscosity of 15-25 mPa·s at 25°C, of at least 8;
(vi) comprising (A) having an HLB of 11-19, and having an emulsifiability index t for an oxidized polyethylene wax, having a weight-average molecular weight of 9000-10000 and an acid number of 22-24, of at least 8;
(vii) comprising (A) having an HLB of 7-15, and having a index of detergency for a synthetic dirts of the following formulation [standardizing detergency of nonyl-phenol ethylene oxide 9.5 moles adduct as 100], supproted on a slide glass, of at least 100:

(synthetic dirts formulation)   tallow   16.6%

                                     soybean oil   16.6%

monoolein	0.4%
oil red	0.2%
chloroform	66.2%
total	100.0%;

(viii) comprising (A) having an HLB of 10-14, and having a viscosity index of 5% aqueous solution [standardizing viscosity of 5% aqueous solution of nonylphenol ethylene oxide 8.5 moles adduct as 100] of at least 50.

5. The nonionic surfactant according to Claim 1, wherein (A) is one having a freezing point satisfying the following relation (9) and having an HLB of 7-15:

$$1.61x-102 \leqq y \leqq 1.61x-92 \tag{9}$$

wherein x represents % by weight of the units represented by (C_2H_4O) in the general formula (1) formed by addition of ethylene oxide, and y represents the freezing point (°C) of (A).

6. The nonionic surfactant according to Claim 1, wherein said (a1) is one selected from the group consisting of saturated aliphatic alcohols, unsaturated aliphatic alcohols and cycloaliphatic alcohols, containing 8-24 carbon atoms.

7. The nonionic surfactant according to Claim 1, wherein said (a1) is one or two or more selected from the group consisting of octyl alcohol, nonyl alcohol, decyl alcohol, undecyl alcohol, dodecyl alcohol, tridecyl alcohol, myristyl alcohol, cetyl alcohol, stearyl alcohol, nonadecyl alcohol, octenyl alcohol, decenyl alcohol, dodecenyl alcohol, tridecenyl alcohol, pentadecenyl alcohol, oleyl alcohol, gadoleyl alcohol, linoleyl alcohol, ethylcyclohexyl alcohol, propylcyclohexyl alcohol, octylcyclohexyl alcohol, nonylcyclohexyl alcohol and adamantyl alcohol.

8. An emulsifier, dispersant, solubilzer, detergent,

penetrating agent or wetting agent, comprising the nonionic surfactant according to any one of Claims 1-7.

9. A process for producing an aliphatic alcohol alkylene oxide adduct,

which comprises addition reaction of an aliphatic alcohol alkylene oxide adduct (e), obtainable by adding 1-2.5 moles on the average of an alkylene oxide (b2) containing at least two carbon atoms to an aliphatic alcohol (a2) containing 1-24 carbon atoms in the presence of a catalyst (d) providing an adduct having a distribution constant c' of 1.0 or less as determined by the following equation (4'),

with an alkylene oxide (b3) containing at least two carbon atoms in the presence of an alkaline catalyst (f):

$$c' = (v' + n_0'/n_{00}' - 1)/[Ln(n_{00}'/n_0') + n_0'/n_{00}' - 1]$$

$$(4')$$

wherein v' represents the average addition molar number of alkylene oxide added per 1 mole of the aliphatic alcohol (a2), n_{00}' represents the molar number of the aliphatic alcohol (a2) used in the reaction, and n_0' represents the molar number of the aliphatic alcohol (a2) unreacted.

10. The production process according to Claim 9, wherein the catalyst (d) is at least one selected from the group consisting of perhalogenoic acids or salts thereof, sulfuric acid or salts thereof, pospholic acid or salts thereof and nitric acid or salts thereof.

11. The production process according to Claim 10, wherein the catalyst (d) is a perchlorate of a divalent or trivalent metal.

12. The production process according to Claim 9, wherein the catalyst (d) is used in an amount of 0.001-1 part by weight per 100 parts by weight of the total of (a2) and

(b2).

    13.   The production process according to Claim 9, wherein (e) is one obtainable by introducing (b2) into (a2) under a pressure of -0.8-5 kgf/cm^2 at a temperature of 80-200℃ followed by carrying out aging at a temperature of 80-200℃ until the pressure within the reaction system reaches equilibrium.

    14.   The production process according to Claim 9, wherein the catalyst is removed from the polymerization product, after termination of the addition-reaction of (b3), through adsorption treatment by adding an adsorbent and optionally a filter aid, followed by filtering operation.

    15. An anionic surfactant obtainable by anionization of an aliphatic alcohol alkylene oxide adduct (A'),
    said (A') being directly produced by adding an alkylene oxide (b1) to an aliphatic alcohol (a1) and satisfying the following (ii'), (iii') and (iv):
(ii') having a ratio Mw/Mn of a weight-average molecular weight (Mw) to a number-average molecular weight (Mn) satisfying the following relation (2') or (3'):

$$Mw/Mn \leqq 0.030 \times Ln(v'') + 1.010 \quad \text{(in case of } v'' < 10) \quad (2')$$
$$Mw/Mn \leqq -0.026 \times Ln(v'') + 1.139 \quad \text{(in case of } v'' \geqq 10) \quad (3')$$

wherein v'' represents the average of (m'+n'+p') in the following general formula (1');
(iii') having a distribution constant c'', determined by the following equation (4''), of 1.0 or less, this being required only in case of v up to 12:

$$c'' = (v'' + n_0/n_{00} - 1)/[Ln(n_{00}/n_0) + n_0/n_{00} - 1] \quad (4'')$$

wherein v" is the same in the above, n_{00} represents the molar number of the aliphatic alcohol (a1) used in the reaction, and n_0 represents the molar number of the aliphatic alcohol (a1) unreacted; and

5 (iv) comprising one compound represented by the following general formula (1'), or a mixture of two or more thereof:
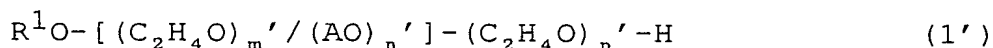
$$R^1O-[(C_2H_4O)_m'/(AO)_n']-(C_2H_4O)_p'-H \qquad (1')$$

wherein R^1 is an aliphatic hydrocarbon group containing 8-24 carbon atoms or a cycloaliphatic hydrocarbon group containing 8-24 carbon atoms; A is an alkylene group containing at least 3 carbon atoms; m' is 0 or an integer of 1 or more, the average thereof being in the range of 0-5, n' is 0 or an integer of 1 or more, the average thereof being in the range of 0-5, p' is 0 or an integer of 1 or more, the average thereof being in the range of 0-10, (m'+n'+p') is an integer, the average thereof being in the range of 1-20, and average of (m'+p')/(m'+n'+p') is at least 0.5; and, in case of m' $\neq$ 0 and n' $\neq$ 0, { $(C_2H_4O)_m'/(AO)_n'$ } represents block addition or random addition;

20   16. The anionic surfactant according to Claim 15, wherein said anionization is sulfation.

    17. The anionic surfactant according to Claim 15, wherein said anionization is phosphation.

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    18. The anionic surfactant according to Claim 15, wherein said anionization is carboxyetherification.

    19. The anionic surfactant according to Claim 15,
30   wherein said anionization is sulfosuccination.

    20. A detergent composition comprising said anionic surfactant according to Claim 15.

21. A detergent composition comprising said anionic surfactant according to Claim 15 and an amphoteric surfactant and/or a nonionic surfactant.